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Water Spray Protects Stored Logs in Hilo, Hawaii

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ABSTRACT: *Eucalyptus robusta* logs continuously sprayed with water for 3½ months were compared with logs left unsprayed. Water spraying greatly reduced damage from end splitting, stain, and insect attacks--even though Hilo, Hawaii, has a very high annual rainfall. Coating log ends with a wax emulsion reduced end splitting, but was not as effective a protective treatment as keeping logs continuously wet.

Wood stain and decay fungi flourish in the warm humid climate of Hawaii, where wood boring insect populations go through many life cycles each year. Logs of most timber species can deteriorate quickly during storage. Stored logs of some species--particularly eucalypts--often split open at the ends owing to growth stress and end drying.

Despite their small size, mills in Hawaii have not found it practical to operate without at least a small inventory of decked logs. They need this backstop to avoid mill shutdowns during logging delays caused by overly wet periods in the forest. Logs of certain species and grain characteristics are also held for lengthy periods speculatively in anticipation of special orders.

One possible method of reducing degrade in stored logs is to spray them with water either continuously or intermittently.[1] This simple method has been found to greatly reduce damage from stain, checking, and less positively, insect damage.

To see if this method would be usable in a very humid climate, we conducted a study at Hilo, Hawaii, where rainfall averages 139 inches annually. We felt that wood-damaging organisms, having developed in this humid environment where stored logs are wet from rain much of the time, might be less deterred by water spray than in an environment with less rainfall.

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[1] Carpenter, B. E. Southern hardwood log storage--practices, problems, and benefits. Ala. Forest Prod. 7(10): 18-22, illus. 1964.
Carpenter, B. E., and Toole, E. R. Sprinkling with water protects hardwood logs in storage. South. Lumberman 207(2576): 25-26, illus. 1963.
Liversidge, R. M., and Finighan, R. Protection of hardwood mill logs during storage. C.S.I.R.O. Forest Prod. Newsletter No. 298 (Melbourne) 4 pp., illus. 1963.
Vick, H. Storage of hardwood logs by the water spray system. South. Lumberman 209(2609): 198-202. 1964.

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The experiment was carried out in cooperation with Hawaiian Fern-Wood , Ltd., which provided the logs, yard space, milling, and handling, and with the Hilo Board of Water Supply, which provided free water from the city's water system.

PROCEDURE

We set up two piles of 20 robusta eucalyptus (Eucalyptus robusta) logs each. One of these piles was kept constantly wet under continuous water spray from lawn sprinklers and perforated lawn soaking hose, while the other pile was left untouched as a control (fig. 1). Before placement in the piles, each log was examined for freedom from stain or insect damage. Though the logs were freshly cut, they all contained end splits caused by growth stress in the trees. The length and width across the end of each split were measured initially, and both ends of each log were photographed. The logs were bucked from tree lengths in the mill yard, making it possible to separate logs from the same tree into equal representation in the sprayed and control piles. The spraying was continued for 3-1/2 months.

Figure 1.--The two log piles early in the study.

Since we had six logs left over, we end-coated with a wax emulsion and placed them in a separate pile. End splitting in these logs was compared with that in the control logs at the end of the test period.

At the end of the study all logs were re-examined, re-measured, and photographed. Insect damage to each log was rated. The logs were then sawed into 1-inch boards. After edging of those boards needing it, the lumber from each pile was sorted into boards containing stain, boards containing insect damage, and boards without either defect.

RESULTS

After about 1 month of storage--long before the study's conclusion--it was already obvious that logs in the sprayed pile were in much better condition than those in the control pile. End splitting and insect damage were markedly less in the sprayed logs. As time passed, these differences became even more apparent. Insects attacked only small areas on the underside of some sprayed logs that the water did not keep continuously wet. On the other hand, most of the control logs were riddled by insects. End splits present initially opened hardly at all in the sprayed logs, but enlarged and increased in number in the control logs. The sprayed logs became covered with slime mold and were blackened on bark-free surfaces, so that it was impossible to predict the progress of stain before the logs were sawed.

Oddly, during the third month of storage, dormant buds sprouted prolifically from underneath the bark of the dry control logs. Only one tiny sprout appeared, however, on one log in the sprayed pile. The water spray, instead of inducing sprouting as might be expected, eliminated it.

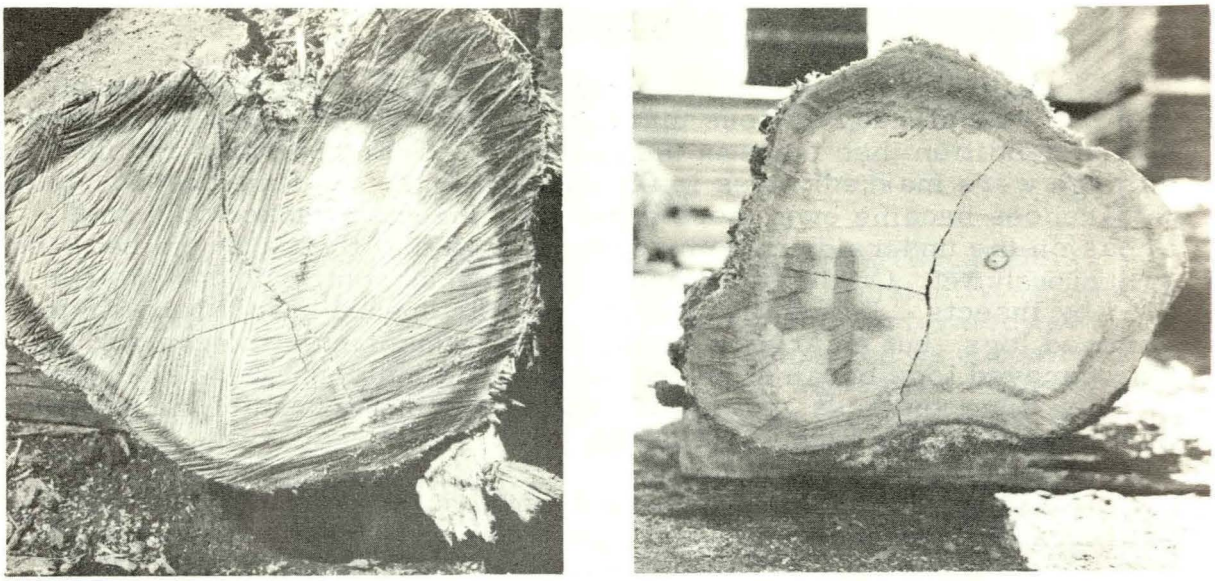
END SPLITTING

Before the study and again after concluding it, end splits in the logs were measured. The lengths of all splits across both log ends were totaled for each log. The width of each individual split was also measured, totaled, and averaged for each log. The average increase in total linear inches of end splitting was 150.3 inches per control log, but only 16.8 inches per sprayed log--a highly significant difference. The increase ranged from 68 to 270 inches in the control logs and from 0 to 44 inches in the sprayed logs. Because many new narrow splits developed in the control logs, average width figures did not prove meaningful. Increase in end split width averaged 0.033 inch for the control logs, and 0.022 inch for the sprayed logs. The contrast in end splitting between sprayed and control logs could be easily seen (fig. 2).

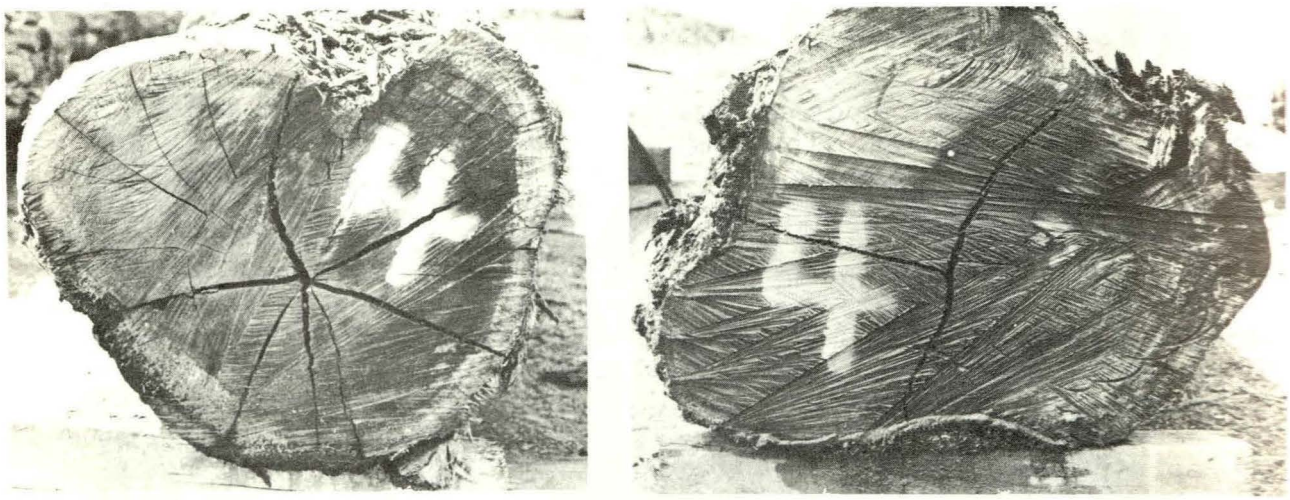
STAIN

Stain showed up when the logs were sawed into 4/4 lumber. It was confined to the sapwood in both sprayed and control logs. The stain in the sprayed logs was confined to small, deep blue-black patches usually associated with bark-free surfaces on the logs. Never deeper than 3/4 inch from the log sides, it did not penetrate the ends at all. Most of this stain was edged off.

The stain in lumber from the control logs was also patchy, but extended much deeper into the sapwood from the log sides. On every log the stain had penetrated the ends 8 to 10 inches. It was usually grayish-brown rather than blue, with occasional yellow streaks showing up in some pieces. Although in some logs the stain had advanced



Log ends before storage



Control Sprayed

Log ends after storage

Figure 2.--Control and sprayed log ends, before and after treatment.

sufficiently for wood deterioration to set in, in most cases it did not appear as serious a defect as the stain in the sprayed logs because of its lesser coloration. Most of the edged lumber from the control logs containing sapwood had patches of stained sapwood.

INSECT DAMAGE

Insects attacking the logs were mostly ambrosia beetles (Xyleborus sp.). Entrance and emergence holes and frass deposits indicated that they had probably gone through two life cycles during the period of 3-1/2 months of storage. They were very active in the yard during the time of sawing and examining the logs and lumber. The insects were probably then in their third life cycle. Their population builds up at about 6-week intervals.

A rating system was devised by which to classify insect damage to the logs at the study's conclusion. This system was based on log surface area in square feet. A log without insect damage was classed as 1. One with one or more holes confined within 2 square feet of surface area, either in one patch or two, was classed as 2. Three to five affected square foot patches caused a rating of 3. Five or more patches rated class 4. Results of the rating were as follows:

Rating	Sprayed logs (number)	Control logs (number)
1	11	0
2	4	2
3	5	2
4	0	16

It is obvious that far more insect damage occurred in the control logs. The ambrosia beetles had carried stain fungi into their galleries--in both control and sprayed logs.

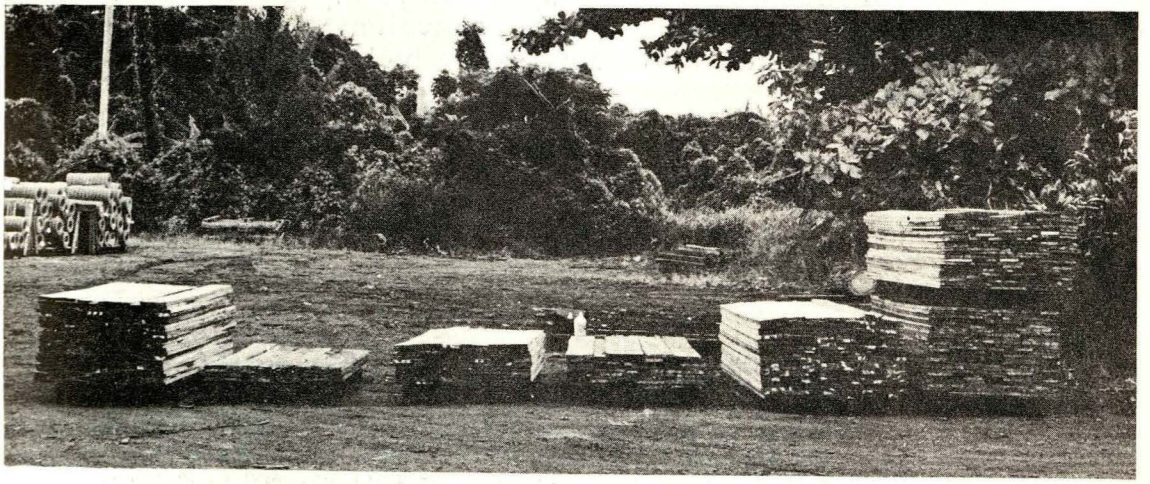


Figure 3.--Lumber cut from the study logs. Left pair--insect and stain damaged, control on left. Center pair--stain damaged, control on left. Right pair--neither defect, control on left.

Lumber produced from the two sets of logs was sorted into separate piles, depending on presence of insect damage, presence of stain, or absence of either. One insect hole was sufficient to place a board in the insect-damaged category. The piles were laid out to simulate a bar graph (fig. 3). Most of the insect damaged lumber also contained stain. This accounts for the relatively small amount of lumber containing stain in the control logs. No attempt was made to grade the lumber.

Board footages represented provide a further indication of the benefits derived from spraying and were as follows:

	Sprayed logs	Control logs
	(board feet of lumber)	
Damage category:		
Insect damaged (+ stain)	160	920
Stain damaged	360	440
Not damaged	1,880	920
Total	2,400	2,280

END COATING

End splits in the six logs that were end coated were measured in the same way as in the other logs. Since the six logs were all small (11 to 13 inches at the small end), they were compared with only the smaller of the control logs (eight logs, 12 to 14 inches).

Average increase in end splitting in the end-coated logs amounted to 67.2 inches. This increase was highly significantly less than the average of 96.1 inches for the unsprayed controls. But it was much more (highly significant) than the average for equivalent sprayed logs. These eight logs, 13 to 15 inches at the small end, had an average increase of only 12.6 inches.

The Author

ROGER G. SKOLMEN's first Forest Service assignment, in 1959, was as a member of the Experiment Station's soil-vegetation survey in Berkeley and Arcata, Calif. In early 1961, he joined the Station's research staff in Honolulu, Hawaii, where he has been investigating the uses, properties, and processing of forest products. A native of San Francisco, he holds bachelor's and master's degrees in forestry from the University of California at Berkeley.